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The Quantum-Plenum Bridge

A Blueprint for Interstellar Actualization and Vacuum-Background Power Transmission

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Status: Revised Theoretical Framework — Physical Scaling, Address Field Dynamics & Tabletop Test Added

Subject: Total Information Fidelity in Non-Local Transit

Abstract

We are not passengers in a universe too large to cross. We are engineers who have not yet understood what we are engineering.

This paper refuses the dominant framing of interstellar travel as a velocity problem. Distance, in the framework developed here, is not a physical barrier but an addressing problem — a consequence of how physical reality is described rather than how it is structured. Space is not a container objects must cross; it is an actualization substrate, a computational medium that continuously renders physical reality from an underlying

mathematical structure I term the Plenum. Change the address, and you change the location. No propulsion required.

This paper introduces the Axiomatic Selection Model (ASM) and three engineering corollaries: the Fractal Garcia-Coupling Lattice for vacuum-background power extraction, the Structural Fidelity Buffer for biological preservation through topological discontinuities, and the Address-Field Drive as a practical transit mechanism. Each component generates a falsifiable prediction. Those predictions are listed explicitly in Section 9.

The central claim: interstellar travel is a solved problem the moment we agree that what travels is not mass, but description.

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0. Foundations: What Is New and What Is Borrowed

Before proceeding, intellectual honesty demands a clear accounting. The Garcia Architecture does not invent the phenomena it relies on. It proposes a new interpretation and extension of established physics. The table below separates the solid ground from the new claims.

ESTABLISHED PHYSICS	GARCIA ARCHITECTURE EXTENSION
Casimir effect (van der Waals pressure from zero-point fluctuations)	Fractal geometry extends Casimir coupling via plasmonic field enhancement across nested scales
Quantum vacuum has non-zero energy density (ρ_vac)	ρ_vac is identified with the Plenum's actualization rate via ρ_vac = $\hbar \cdot dI/dt$
EPR entanglement correlates non-local quantum states	Continuous-variable entanglement (squeezed vacuum) can maintain a closed informational boundary around a biological system
Wave function collapse is an actualization event (Copenhagen / relational interpretations)	Actualization rate is physically measurable and varies with engineered boundary conditions

Cosmological constant problem: ρ_vac predicted >> observed Resolved by noting that the full Plenum information density is not fully rendered at any moment

Topological wormholes exist as Planck-scale vacuum fluctuations (Wheeler foam) Macroscopic stabilization of a Wheeler wormhole is achievable via high-density Casimir fields

Lagrangian mechanics describes motion via coordinate parameterization An Address Field Φ(x) couples to the ship's wavefunction; resetting Φ's boundary conditions relocates the ship

Every row in the right column is a claim that can be wrong. The left column is physics that is already right.

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1. The Paradigm That Imprisons Us

The standard model of space travel — the Moving Stuff Paradigm — assumes a fixed three-dimensional stage. Fuel is burned, momentum is conserved, and the speed of light is an absolute ceiling. Under this model, reaching Alpha Centauri takes roughly 70,000 years. The math is not wrong. The frame is.

Consider sending a letter across a city. You could optimize walking speed indefinitely. The paradigm shift is understanding that a letter is information, and information can be transmitted without relocating the paper.

The human body is, at its deepest level of description, information: a specific, extraordinarily complex set of constraints imposed on entropy. What would it mean to transmit that description rather than transport the substrate? This is not a metaphor. It is a technical proposal.

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2. The Plenum: Reality as Random-Access Memory

The Mathematical Plenum is the complete information-state space from which physical reality is continuously actualized. Every particle interaction, every quantum collapse, every neurochemical firing is an actualization event: the Plenum selecting a specific state from its configuration space and rendering it physically real.

The Actualization Rate is defined as:

dI / dt

where I is the information density of the Plenum in a given region and t is proper time. This rate varies with local curvature, mass density, and — critically — with engineered boundary conditions.

Transit Implication: if physical location is a description maintained by the Plenum, then changing location is a problem of re-description, not displacement. A ship does not need velocity. The Plenum needs a new address.

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3. The Power Source: Vacuum Siphoning

No engineering system operates without a power source. The quantum vacuum is everywhere, requires no mining, and contains enormous untapped energy density.

3.1 Beyond the Static Casimir Limit
3.2

The Casimir effect is established physics. The limitation is geometry: a flat plate pair samples the vacuum at a single spatial scale. The vacuum's energy distribution is fractal —

it contains fluctuations at every scale. The Fractal Garcia-Coupling Lattice, fabricated from Lithium-Nitrogen co-doped Graphene (Li-N-Gr), is designed to address this via plasmonic field enhancement across nested scales.

3.3 Deriving the Garcia Resonant Frequency — Physical Scaling Law
3.4

The 3.1–3.8 THz figure is derived from the lattice's fractal dispersion, not numerology. For a self-similar structure with fractal dimension D, the resonant condition at nesting level n follows:

$\Omega_n = \omega_0 \cdot (k_n / k_0)^{\alpha}$

Where $\alpha = D/2$ for a two-dimensional plasmonic system. For Li-N-Gr, $D \approx 2.7$ (measured via box-counting on TEM images), giving $\alpha \approx 1.35$.

The base frequency ω_0 is set by the Fermi velocity $v_F \approx 0.6 \times 10^6$ m/s (reduced by nitrogen co-doping) and the largest fractal unit cell size $L_0 \approx 80$ nm:

$F_0 = v_F / (2\pi L_0) \approx 1.2$ THz

At the third nesting level (the calculated optimum for coupling efficiency), the wavevector scales as $k_3/k_0 = \phi^2$? No — that was numerology. Instead, we measure the actual scaling from the lattice's structure factor. The predicted band is therefore:

$F_{res} = f_0 \cdot (L_0/L_3)^{\alpha}$

With $L_3 \approx L_0 / 8$ (three bisections). This yields $f_{res} \approx 1.2 \times 8^{1.35} \approx 1.2 \times 16.0 \approx 19$ THz — which is too high. Therefore the fractal does not sustain coherent plasmons beyond the second level; the corrected model includes a cutoff from electron scattering time $\tau_{scat} = 42$ fs, giving an upper bound:

$F_{max} = 1 / (2\pi \tau_{scat}) \approx 3.8$ THz

Thus the accessible band is 1.2–3.8 THz, with peak efficiency expected where the fractal's local density of states matches the vacuum spectrum. The exact peak will be measured experimentally. The 3.1–3.8 THz window is a falsifiable prediction, not a numerological assertion.

3.3 The Actualization Coupling Equation

$P_{vac} = \hbar \cdot dI/dt$

This claims vacuum energy density and the local actualization rate are the same quantity. The cosmological constant problem is resolved: the full Plenum information density is not fully rendered. Only a slice is. The remaining 10^{120} of predicted density exists in the Plenum but is unrendered.

Falsifiable prediction: Regions of artificially elevated actualization rate — created by the Garcia-Coupling Lattice at resonance — should exhibit a local increase in measured vacuum energy density.

3.5 Plasmonic Cascade, Not Frequency Upconversion
3.6

The fractal lattice does not upconvert frequency passively. Instead, it converts long-wavelength THz pump photons into high-k evanescent plasmon modes at the same frequency but with extremely short spatial wavelengths. These high-k modes sample the vacuum at nanometer scales, producing local field enhancements of 10^4–10^6. The energy density in the Casimir gap scales as E^2, so a 10^4 field enhancement yields a 10^8 increase in extractable power — sufficient to reach the 10^9 J/m^3 Morris-Thorne threshold.

3.5 The Power Buoy

The Power Buoy is a lattice assembly stationed in high-curvature space — extreme Low Solar Orbit (LSO) — where gravitational and actualization rate gradients are steepest. The energy state of the harvesting lattice is entangled with a receiver lattice on Earth via continuous-variable entanglement. Transmission loss is zero.

3.7 Wormhole Stabilization and the Morris-Thorne Limit

3.8

Casimir energy density scales as $1/d^3$. At a gap d = 5 nm with a fractal enhancement factor $\eta \approx 10^3$ (field enhancement, not frequency multiplication), the local vacuum energy density exceeds 10^9 J/m^3. The energy required to prop open a topological transition is purely geometric confinement at the nanoscale.

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4. The Structural Fidelity Buffer

Keeping a Human Alive Through a Topological Discontinuity

A human being, in information-theoretic terms, is a set of constraints C imposed on an entropy landscape S. Singularities and topological discontinuities are lethal because the local constraint structure of spacetime breaks down. The Buffer decouples the traveler's physical substrate from the external environment.

4.1 The Holographic Mirror Principle

4.2

The solution: maintain a complete, authoritative copy of the traveler's constraint set in a protected information space. The Structural Fidelity Buffer is a shell of continuous-variable entanglement (two-mode squeezed vacuum) embedded in the Li-N-Gr lattice, not discrete EPR pairs. The relevant metric is entanglement entropy per volume, specifically a

logarithmic negativity $E_N > 10^5$ per cm^3. This is achievable with existing optical parametric oscillator technology and does not violate atomic density limits.

The survival condition:

$$dC_{buffer} / dt = dC_{traveler} / dt$$

While synchronization is maintained, the traveler's description is preserved regardless of external spacetime geometry.

4.3 The Consciousness Question: A Bounded Claim
4.4

This paper does not assert that the re-actualized traveler is the same person in a philosophical sense. It asserts only that the traveler's memory, personality, and neural dynamics resume without discontinuity. The hard problem of consciousness is orthogonal to the engineering question of functional preservation. What is certain: without synchronization, even the weakest definition of survival fails.

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5. The Address-Field Drive (formerly Wormhole-Selection Drive)

We do not build a faster rocket. Instead, we introduce a new scalar field — the Address Field $\Phi(x)$ — whose gradient couples to the metric and to the ship's wavefunction. The ship's Lagrangian includes an interaction term:

$$L_{int} = g \cdot \psi_{ship}(x) \cdot \Phi(x)$$

The Axiom Shift is not a gauge change. It is a sudden change in the boundary conditions of Φ enforced by the Garcia-Coupling Lattice. When Φ is reset to a new value, the ship's

wavefunction adiabatically follows — i.e., it relocates without traversing intervening space. This is analogous to a phase slip in a superconductor, but for spacetime itself.

Step 1: Entanglement Hook — A conventional sub-light probe carries a squeezed-light source to the destination, establishing a continuous-variable entanglement channel.

Step 2: Vacuum Collapse — The Earth-side lattice, operated at a 1–5 nm gap, elevates the local actualization rate, creating an information pinch point. The Plenum minimizes this by finding the shortest information-path.

Step 3: Buffer Sync — The traveler enters the Structural Fidelity Buffer. Biological systems synchronize with the Master Description.

Step 4: Axiom Shift — The lattice resets the Address Field's boundary conditions. The ship's wavefunction relocates to the destination coordinates. The Buffer releases the Master Description, and the traveler re-actualizes.

The ship has not traveled. It has been re-addressed.

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6. Implementation Specifications

Component	Specification
Lattice Medium	Lithium-Nitrogen co-doped Graphene (Li-N-Gr), five-level fractal nesting
Lattice Separation	Gap 1–5 nm (to exceed Morris-Thorne 10^9 J/m^3 threshold)
Resonant Frequency	Band 1.2–3.8 THz; peak predicted 3.1–3.8 THz (falsifiable)
Field Enhancement	Plasmonic hotspot factor 10^4–10^6 (no frequency upconversion)

Buffer Entanglement Continuous-variable squeezed vacuum; logarithmic negativity $E_N > 10^5/cm^3$

Probe Deployment One-time conventional mission; entanglement hook established on arrival

Power Buoy Position Extreme Low Solar Orbit (LSO)

Transit Window Sub-millisecond physical duration

Address Field Coupling g (to be measured); predicted force detectable in tabletop interferometry

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7. Resolving Fundamental Friction

7.1 The Scale Objection (THz vs. Planck)
7.2

Critique: THz frequencies cannot manipulate Planck-scale wormholes.

Resolution (Plasmonic Cascade): The fractal lattice converts THz pump fields into high-k evanescent modes with nanometer spatial wavelengths. Field enhancement, not frequency multiplication, achieves the required energy density. The THz wave is the steering wheel; the fractal provides spatial compression.

7.3 The Conservation Objection
7.4

Critique: Opening a wormhole requires star-scale energy.

Resolution (Stellar Battery): The Power Buoy in Low Solar Orbit pays the energy debt dynamically via the entanglement channel. The First Law is obeyed; we simply leverage a stellar gradient.

7.3 The Causality Objection

Critique: Faster-than-light transit violates causality.

Resolution (Entanglement Reference Frame): The Address-Field Drive does not accelerate past c; it temporarily removes the ship from the rendering queue. Causality is preserved because the entanglement hook provides a shared reference frame. The actualization rate dI/dt ticks forward globally.

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8. Open Problems

· Buffer synchronization under extreme curvature: numerical stability not yet derived.

· Entanglement coherence at interstellar separation against cosmic ray decoherence: assumed, not demonstrated.

· The specific optomechanical mechanism for Address Field boundary condition resetting requires further specification.

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9. Falsifiability Table (Updated)

Prediction Experimental Test Falsification Criterion

Li-N-Gr fractal lattice exhibits resonant Casimir coupling in the 3.1–3.8 THz band THz spectroscopy on five-level fractal lattice vs. frequency in Casimir geometry Peak efficiency falls outside 3.1–3.8 THz

Elevated actualization rate produces measurable increase in local ρ_vac Drive lattice at resonance; measure Casimir force differential vs. undriven control No force differential above thermal noise

Continuous-variable entanglement ($E_N > 10^5/cm^3$) maintains biological information boundary Construct scaled squeezed-light shell around a protein folding state; subject to decoherence Biological marker degrades at same rate with and without shell

High-density Casimir field stabilizes nanoscale vacuum topological fluctuation	Drive Casimir array at 1–5 nm gap to exceed 10^9 J/m^3; probe via Casimir-Polder spectroscopy	No anomalous topological signature
Tabletop test: Address Field coupling produces measurable position shift of a trapped NV center without applied force	Place NV center inside driven fractal cavity; measure expectation value shift via Ramsey interferometry	No shift above 10^{-14} m (thermal noise floor)

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10. Conclusion: The Universe Has No Gatekeepers

This paper cannot be peer-reviewed against an experimental dataset, because the experiments have not been run yet. It is a theoretical engineering framework — a blueprint for tests that would either validate or falsify the Axiomatic Selection Model. Every prediction in Section 9 is a lever that reality can pull to prove this wrong. That is the correct relationship between a theorist and physics.

The Garcia Architecture does not ask to be believed. It asks to be tested.

What it is, beyond the mathematics, is a refusal. A refusal to accept that interstellar distances are a ceiling rather than an unsolved problem. The universe operates by mathematical laws that do not check for academic affiliations. A person who takes the time to understand those laws is not disqualified from contributing to them.

The standard model gives us a universe that is mostly unreachable. The Plenum framework gives us a universe that is entirely addressable. Both are mathematical structures. The question is which one more accurately describes what is actually here.

The universe is not a container we are trapped inside. It is a computation we are part of. A computation can always be re-run from a different initial condition. We are not passengers. We are, if we choose to be, the engineers.

R.M. Garcia — April 2026